This more rapid growth was augmented by an increase in labor force participation rates--that is, in the proportion of the population working or seeking work. The combination of two trends--slowing real GNP growth and rising employment growth--implies a massive slowdown in the trend growth of real GNP per person employed. (Trend growth is the rate of growth after the effects of business fluctuations have been removed.) This latter measure grew rapidly until the early 1970s, at an average annual rate of 2.1 percent, but in succeeding years the average fell to 0.5 percent. 1/

The simple comparison of average growth rates for two periods is not enough to show whether there has been a change in the rate of trend growth. Much depends on the choice of time periods--in part because of the business cycle. The comparison given above of GNP growth rates was for the 1948-1973 and 1973-1985 periods. If the first period is changed to 1953-1971 (in order to exclude the Korean War years) and the second period to 1972-1985, the respective average annual growth rates of real GNP are not 3.7 percent and 2.3 percent but 3.1 percent and 2.5 percent--a difference of much lesser magnitude. 2/

The change in the trend growth of real GNP per person employed is not subject to such ambiguity, however. Regardless of the time period chosen, this aggregate measure of productivity has exhibited a significant slowdown since the mid-1960s.

Though the growth rate of productivity is influenced by short-run fluctuations in economic activity, the change in trend growth is clearly the result of long-run factors related to supply. The most important of these factors are:

- Slowing of growth in the amount of capital per worker, perhaps related to budget deficits;
- Higher energy prices;

1. There has not yet been a significant slowdown in the growth of output per capita. In contrast to output per person employed, per capita output grew slowly during the 1950s because of a high birth rate, and as the baby boom eased in the 1960s, per capita GNP growth picked up. It subsequently slowed slightly in the early 1970s, but so far the data do not show that the trend growth rate of per capita output has fallen.

2. Statistical tests for changes in trend growth rate of real GNP indicate that the difference in trend growth rates is statistically significant if the Korean War years are included, but not significant if they are excluded. The statistical significance can be tested by regressing the log of real GNP against time for various periods and then using the standard F-test to determine whether or not the difference in the coefficients of the time variables is significant.

- o Rapid changes in inflation;
- o Acceleration of new entrants into the work force;
- o More government regulation;
- o Reduction in public capital formation;
- o Reduction in research and development, and perhaps in the effectiveness of research and development as well; and
- o Prolonged periods of higher than average unemployment.

POTENTIAL OUTPUT AS AN ALTERNATIVE MEASURE OF GROWTH

In analyzing economic growth, it is important to distinguish long-term movements in total output from short-term or cyclical fluctuations. To do this, economists have introduced the notion of potential output--defined as the highest path of output the economy can sustain without increasing inflation. It is an unobserved measure largely determined by existing technologies and by available supplies of labor, capital, and other productive resources. Public policies can raise potential output through incentives that increase the availability and use of such resources, but potential output is thought to respond fairly slowly to policy changes.

Reasonable estimates of potential output can encompass a fairly wide range of values because of measurement problems and conceptual issues. There is also some disagreement about the usefulness of potential output for policy evaluation, especially as a target at which policymakers should aim. 3/ But most economists agree that a measure of potential output, despite its difficulties, is a useful tool of macroeconomic analysis.

Inflation and Unemployment at Potential Output

The definition of potential output as the highest path of output that can be sustained without increasing the rate of inflation is associated with a widely held view about labor markets--namely, that the demand for labor and

3. For a criticism of potential output as a policy target, see William Fellner, "The High-Employment Budget and Potential Output: A Critique," *Survey of Current Business* (November 1982), pp. 26-33.

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the supply of it are in balance when the growth of money wages is stable. Under such conditions, the rate of price inflation also tends to be constant (but not necessarily zero), and the economy is at its "stable-inflation" rate of unemployment--a rate that excludes cyclical unemployment. 4/ At lower rates of unemployment, the growth of money wages seems to rise continuously, putting upward pressures on the growth of prices; at higher rates of unemployment, the growth of wages and of prices both seem to decline. Thus, the stable-inflation rate of unemployment is an important factor in determining potential output, because it represents labor market conditions that are consistent with a constant growth of money wages, and thus with a constant rate of price inflation.

This link to constant inflation, however, makes potential output a somewhat elusive concept. Actual inflation is affected by many factors outside labor markets, such as food and oil price shocks. Moreover, to some extent inflation is influenced by inflationary expectations, which may adjust slowly to past experience and to forecasts of future policy and other economic events. In other words, the path of potential growth may be influenced in subtle ways by actual growth. For example, if the economy were to grow along its potential path for a considerable period of time, that very fact might alter this growth. Such theoretical points are not considered to be of enormous importance, however, and the stable-inflation rate of unemployment is thought to be fairly constant from year to year. Nevertheless, it is not easy to estimate the stable-inflation rate of unemployment, nor is it easy to determine the corresponding (potential) level of output. 5/

How High Is the Stable-Inflation Rate of Unemployment?

Most estimates of the stable-inflation rate of unemployment show an increase over the years, roughly ranging from between 4 percent and 5 percent in the mid-1950s to between 5 percent and 7 percent since the

4. In the economics literature, this rate of unemployment is sometimes termed the "nonaccelerating-inflation rate of unemployment" (NAIRU) and sometimes the "natural unemployment rate."

5. In a more general sense, potential output can be defined without reference to the rate of inflation. That is, it can be viewed as the quantity of output that can be produced in the economy, given existing technologies and assumptions about the "normal" utilization rates of available factors of production--mainly capital and labor. In this sense, potential output provides a measure of productive capacity independent of changes in the rate of capacity utilization. For a discussion of this view, see Edward F. Denison, *Trends in American Economic Growth: 1929-1982* (Washington, D.C.: Brookings Institution, 1985).

mid-1970s. 6/ The increase generally is attributed to the influx into the labor market of teenagers and women, who have higher than average unemployment rates. 7/ In principle, factors outside the labor market, such as food and oil price shocks, can temporarily change the stable-inflation rate of unemployment through their impact on actual and expected inflation. Moreover, the stable-inflation rate of unemployment can be affected by public policies such as minimum wage laws, tax incentives, training, and safety-net programs that alter the supply of and demand for labor.

Current CBO Estimates of Potential Output

There are a number of ways to estimate potential output based on a benchmark such as the stable-inflation rate of unemployment. The method used by CBO is described in Appendix A along with the results. In brief, the estimates were based on a postulated statistical relationship (Okun's Law) between actual output and unemployment in excess of the stable-inflation rate of unemployment. 8/ Time trends were added to separate one business cycle from another, and thus to reflect changes in the growth rate of potential output that would show up in the use of more elaborate estimating procedures.

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6. This range of estimates is discussed in Stuart E. Weiner, "The Natural Rate of Unemployment: Concepts and Issues," Federal Reserve Bank of Kansas, *Economic Review* (January 1986), pp. 11-24.

7. The CBO measure of potential output is based on a time series for the stable-inflation rate of unemployment that rises because of demographic factors from about 5 percent in the mid-1950s to roughly 6 percent since the mid-1970s. The source of these estimates is Robert J. Gordon, *Macroeconomics*, third edition (New York: Little, Brown, 1984), Table B-1, Column 6. Somewhat higher estimates are presented by Steven N. Braun in "Productivity and the NIIRU," Board of Governors of the Federal Reserve System, Economic Activity Section Staff Working Paper No. 34 (June 1984).

8. See Arthur Okun, "Potential GNP: Its Measurement and Significance," in *Proceedings of the Business and Economic Stabilization Section of the American Statistical Association* (1962), pp. 98-104. Recently, increased attention has been given to cyclically adjusted measures of output that are not tied to any specific benchmark rate of unemployment. These "trend" measures represent a smoothing of the output series using only information in the series itself. For discussions of such measures, see Peter K. Clark, "The Cyclical Component of U.S. Economic Activity," Research Paper No. 875, Graduate School of Business, Stanford University, August 1986, and Frank de Leeuw and Thomas M. Holloway, "The Measurement and Significance of the Cyclically-Adjusted Federal Budget and Debt," *Journal of Money, Credit, and Banking* (May 1983), pp. 232-242. A related and important study on methodology is A.C. Harvey, "Trends and Cycles in Macroeconomic Time Series," *Journal of Business and Economic Statistics*, 3 (1985), pp. 216-227.

This approach does not explicitly take into account the separate effects on potential output of changes in population growth, labor force participation, average hours of work, or productivity growth. 9/ It also does not explicitly reflect the relationship between potential output and capital formation. The influence of all these factors is implicit in CBO's approach, which estimates the level of output consistent with the stable-inflation rate of unemployment but without estimating the impact of each factor separately.

According to CBO estimates plotted in Figure III-1, potential output grew by 3.7 percent during the 1960s, 3.1 percent during the 1970s, and 2.6 percent since the most recent cyclical peak in the third quarter of 1981. When the growth-rate estimates are based on different subperiods for the time trends, these numbers change somewhat. But regardless of the way the 1953-1986 period is divided, the estimates reveal a declining rate of growth for potential output, beginning roughly in the 1970s.

CAUSES OF SLOWER GROWTH

Most analysts see the slowdown in economic growth beginning around 1973. Real GNP grew at an average rate of 3.7 percent from 1948 to 1973, but only at a 2.3 percent rate from 1973 to 1985--a slowdown of more than one-third or almost 1½ percentage points. Why did this marked slowdown occur? Analysts continue to debate the causes, but something can be learned by examining trends in the labor force and in labor productivity growth (growth in output per hour worked). 10/ Broadly, the data seem to show that slower growth in labor productivity is primarily responsible for the slowing in economic growth. Faster growth in the labor force helped to offset the effect of slower growth in productivity, but did not do so entirely. In the 1980s, productivity appears to have revived considerably in manufacturing and farming but not in the service sector, and labor force growth has slowed somewhat.

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9. Appendix E does, however, break down the growth of potential output into several parts.

10. The discussion here focuses on labor productivity, or real output per hour worked in the business sector. While labor productivity is the measure most widely cited in the business press, "multifactor productivity" measures are also available and are widely used, particularly by economists. Multifactor productivity relates output to a measure of primary inputs including capital.

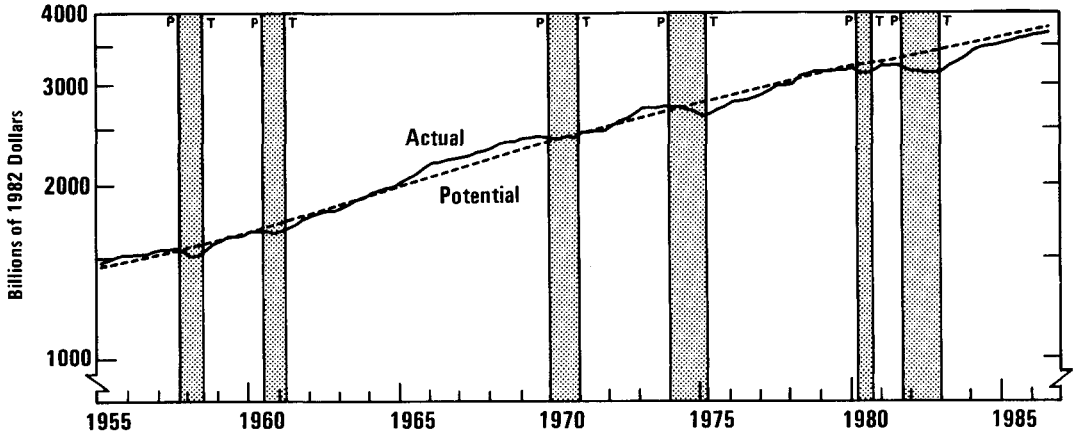
Trends in the Labor Force

The labor force grew roughly twice as fast in the 1965-1981 period as in the earlier postwar period of 1948-1965. After 1981, the growth rate of the labor force fell back nearly to the early postwar level. In the period after 1965, the labor force grew more rapidly both because the working age population grew more rapidly and because the labor force participation rate started to increase. The annual rate of population growth rose by about 0.7 percentage point in the second period compared with the first, and the aggregate labor force participation rate increased about 0.5 percentage point annually. In the 1980s, both population and labor force have grown more slowly than during 1965-1981 (see Figure III-2). The effect on the labor supply, however, has been attenuated by a slower decline in the average length of the workweek.

As shown in Figure III-3, the aggregate civilian labor force participation rate (the ratio of labor force to the population age 16 and older) began increasing in the mid-to-late 1960s, and has continued to rise gradually, almost without interruption, reaching an all-time high of 65.3 percent in 1986--up substantially from an average of 60.4 percent in 1970 and 58.8 percent in 1965.

The upward drift in the aggregate participation rate combines a downward trend among men and an upward trend among women. The bulk of the

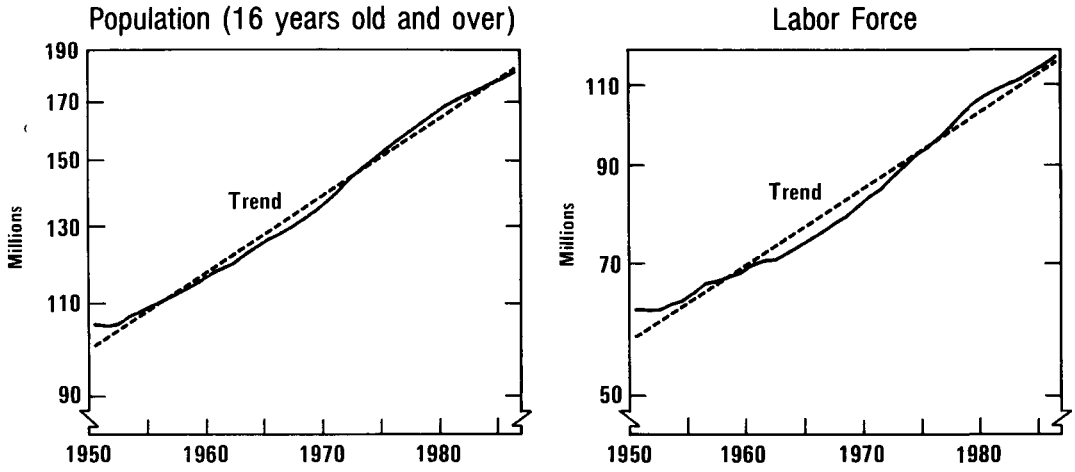
Figure III-1.
Actual and Potential Gross Domestic Product



SOURCES: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

NOTES: Potential GDP estimated by CBO. Vertical axis is a logarithmic scale.

Figure III-2.
Civilian Population and Labor Force



SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

NOTE: Vertical axes are logarithmic scales.

decline in the participation rate of the male labor force has occurred among older men (ages 55 and older) of all races who have retired, and among younger black men. A major factor prompting earlier retirement is believed to be the growing availability of pensions. In addition, the interaction of the Social Security and federal income tax systems has resulted in very high effective marginal "tax" rates for some groups of older workers. In this case, "tax" is construed broadly to include not only conventional payments to the government but also reductions in income transfers from the government. Several factors--both economic and social--are believed to have caused the rise in female labor force participation rates. After 1973, slower growth in real family incomes may have prompted many women to seek jobs. According to some economists, the entry of the "baby boom generation" into the labor force depressed the relative wages of this group and drove many women into the labor market to meet family income goals. 11/ Other economic factors include new goods and services that have reduced the amount of time needed to care for the family, and the

11. See Richard A. Easterlin, *Population, Labor Force, and Long Swings in Economic Growth: The American Experience* (New York: Columbia University Press for the National Bureau of Economic Research, 1968), p. 165; and Michael L. Wachter, "Intermediate Swings in Labor-Force Participation," *Brookings Papers on Economic Activity*, no. 2 (Washington, D.C.: Brookings Institution, 1977), pp. 545-574.

expansion of industries that have traditionally employed women. Finally, social or cultural factors, such as changed attitudes toward women's roles, have probably contributed to more labor force participation by women.

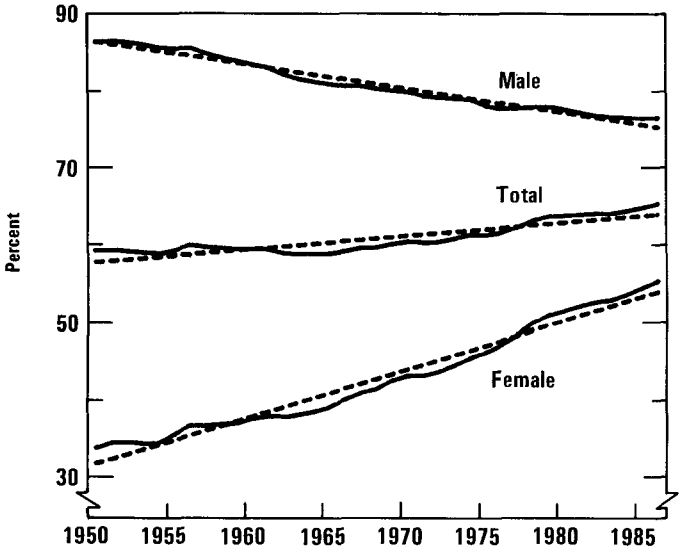
Reasons for the Slowdown in Productivity

Business fluctuations can cause sharp variations in labor productivity in the short run. During recessions productivity tends to decline, or increase less rapidly, and during recoveries it increases especially rapidly. A primary reason is that businesses tend to keep more workers on the payroll than they need during downtimes because workers, especially skilled workers, are costly to replace. As demand picks up, the work force has more to do and growth in productivity rises temporarily above its long-term trend.

Different factors are believed to affect growth in productivity over the long run. One of the most important is the amount of physical capital--such as tools and machinery--used by workers. Higher amounts of capital per worker are associated with increased output per hour worked. Also important are the quality and composition of the capital stock--that is, the degree to which the capital stock embodies the best technology and is allocated to its most productive uses. The development of public infrastructure--such as roads, sewers, airports, and harbors--also contributes to productivity growth in the private sector.

A second major determinant of productivity is the skill, health, and diligence of the work force--sometimes referred to as "human capital."

Figure III-3.
Civilian Labor Force Participation Rates



SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

Better-trained, more knowledgeable workers mean higher productivity. The demographic composition of workers is also relevant, since all groups of workers are not equally productive. Young workers and--on average--women earn lower wages than adult men, and earnings are in part an indicator of training, experience, and productivity. As women increasingly stay in the labor market and as barriers to their entry into high-productivity jobs are reduced, their experience should increasingly yield earnings and productivity equal to that of men. As with capital, the efficiency with which labor is allocated also contributes to higher productivity. If labor is mobile, for example, workers will shift readily among industries or locations in order to take high-wage, high-productivity jobs.

A third factor in the increase of productivity is the development and introduction of new, more efficient technologies. Investment in research and development contributes (with a lag) to the spread of new technology, but it is only one aspect of a much broader process.

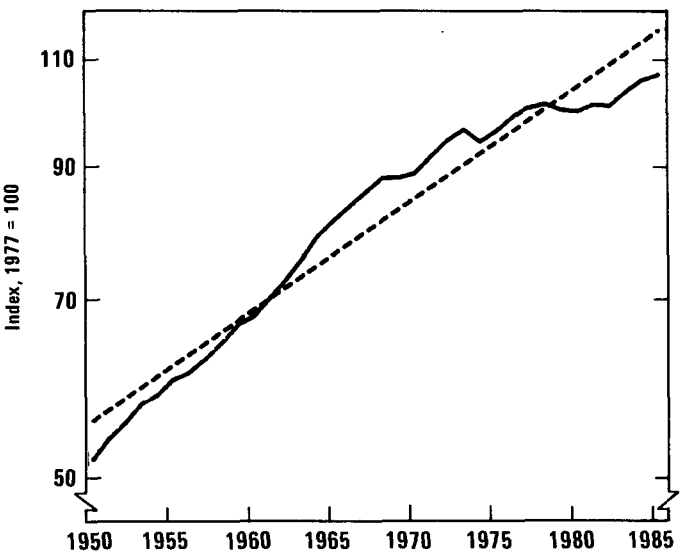
A fourth factor that is critical to productivity is the quality of management and organization. This factor includes the quality of decisions made about what to produce and how to produce it. It also includes how well or how badly labor and management work together.

Finally, several very broad or economywide factors are believed to affect productivity, such as the gains from international trade, and economies of scale that develop with the growth of industries and markets.

Governmental policies can affect growth in productivity, but whether they can have a major positive effect is debatable. Policies designed to improve education and training, tax incentives to spur R&D and investment, and other tax-transfer policies related to work and saving incentives may ultimately help productivity, but their significance is in dispute. Policies that seek to stabilize the economy can help to provide an environment favorable for growth in productivity if they succeed, but some economists oppose them on the ground that the government does not have the knowledge and skill necessary to "fine tune" the economy.

Labor productivity grew especially rapidly in the two decades following World War II, at an average of more than 3 percent per year. Its growth began to slow in the mid-1960s, and in the mid-1970s productivity seemed to remain flat rather than grow. It recovered modestly in the 1980s, but not to the rates of growth that prevailed before 1973 (see Figure III-4).

Figure III-4.
Business Productivity and Its Trend



SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

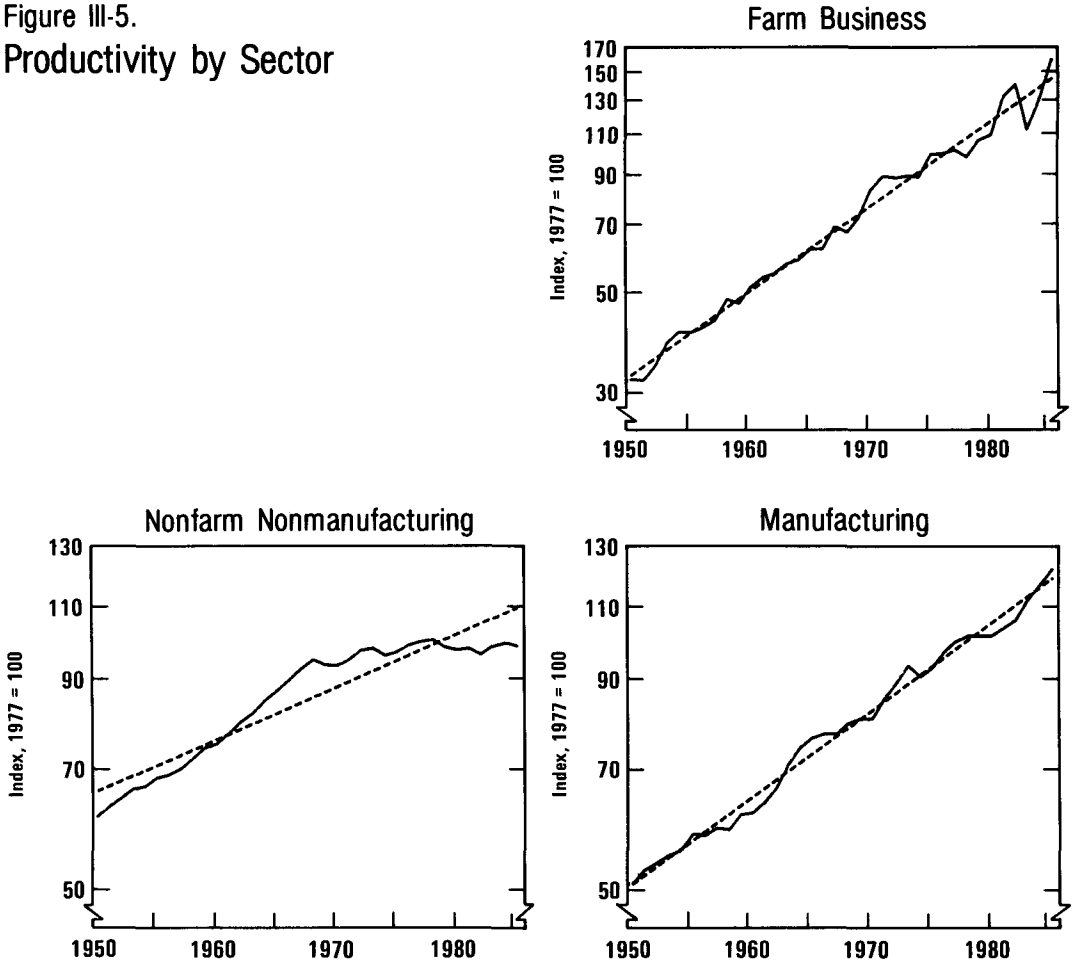
NOTE: Vertical axis is a logarithmic scale.

Different sectors of the economy have varied widely in their productivity performance. During the 1973-1981 period, productivity performance was poor in both manufacturing and nonmanufacturing (Figure III-5). The slowdown now appears to be limited to the nonfarm, nonmanufacturing sector, which has shown almost no measured growth in productivity since the late 1960s. By contrast, the productivity performance of the manufacturing and agricultural sectors appears to be roughly on trend. Indeed, manufacturing growth in productivity from 1981 to 1985 was more rapid than during the 1948-1965 period. 12/

Why did growth in productivity slow in the late 1960s and virtually cease in the 1970s? A vast amount of research on this question seems to yield the following conclusions. First, conventional or growth-accounting

12. Data on recent productivity trends in manufacturing and (nonfarm) nonmanufacturing are subject to wide margins of error.

Figure III-5.
Productivity by Sector



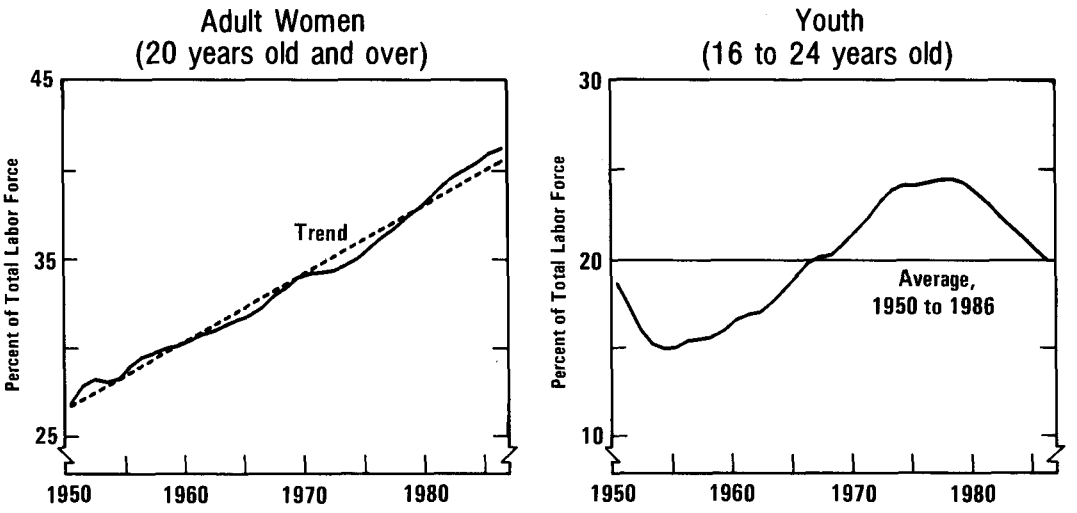
SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

NOTE: Vertical axes are logarithmic scales.

approaches have been able to explain only about half of the slowdown. 13/ Second, a number of causes, rather than a single cause, seem to have been responsible, although analysts differ widely in their assessment of the relative importance of the different causes. Third, some of the apparent slowdown may be the result of measurement problems.

13. The growth-accounting approach, pioneered by Edward F. Denison and John W. Kendrick among others, weighs different factor inputs by the income shares attributable to each input. There have been other approaches to the study of the productivity slowdown, such as econometric approaches. Some of the econometric studies have "explained" nearly all of the slowdown in a statistical sense, but whether actual causation was at work is unclear.

Figure III-6.
Proportions of Adult Women and Youth in the Civilian Labor Force



SOURCES: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics.

The following factors are among those believed to have contributed significantly to the slowdown in productivity and growth:

- The capital/labor ratio grew more slowly, primarily because the labor force grew more rapidly. 14/ In addition, growth in public capital slowed beginning in the mid-1960s.

- Investment in research and development slackened during the period from the late 1960s until about 1975, although much of the slowdown occurred in government-funded R&D rather than in industry-funded R&D. In addition, there may have been a deterioration in the results of given expenditures on R&D. 15/

14. For the private business economy, the capital-to-labor ratio grew at the following annual rates: 1948-1965, 2.6 percent; 1965-1973, 2.9 percent; 1973-1981, 2.3 percent; and 1981-1985, 1.7 percent. (CBO calculations based on data from the Bureau of Labor Statistics.)

15. See, for instance, Martin N. Baily and Alok K. Chakrabarti," Innovation and Productivity in U.S. Industry," *Brookings Papers on Economic Activity*, vol. 2 (1985), pp. 609-632.

TABLE III-1. ESTIMATES OF THE IMPORTANCE OF SELECTED FACTORS IN THE PRODUCTIVITY SLOWDOWN

Factor and Researcher	Periods Compared	Percentage of Slowdown Attributed to Factor
Capital Formation		
Capital/Labor Ratio Growth		
Denison (1979)	1948-73/1973-76	4
Kendrick	1948-66/1973-78	21
Clark	1948-65/1965-73	35
Nadiri	1948-74/1974-78	38
Tatom	1950-72/1972-79	39
Norsworthy and Harper	1948-65/1965-73	-
	1965-73/1973-77	49
Norsworthy, Harper, and Kunze	1948-65/1965-73	-
	1965-73/1973-78	71
Denison (1982)	1948-73/1973-81	8
Vintage Effect		
Kendrick	1948-66/1973-78	10
Clark	1948-65/1965-73	14
	1965-73/1973-78	9
Pollution and Regulation		
Denison (1979)	1948-73/1973-76	13
Kendrick	1948-66/1973-78	16
Denison (1982)	1948-73/1973-81	6
Energy Price Effect		
Denison (1979)	1948-72/1972-76	3
Norsworthy, Harper, and Kunze	1965-73/1973-78	16
Hudson and Jorgenson a/	1948-72/1972-76	approx. 20

SOURCE: Edward N. Wolff, comment on paper by Edward F. Denison, "Accounting for Slower Economic Growth: An Update," in John W. Kendrick, ed., *International Comparisons of Productivity and Causes of the Slowdown* (Cambridge, Mass.: Ballinger, 1984), pp. 50-51.

TABLE III-1. (Continued)

Factor and Researcher	Periods Compared	Percentage of Slowdown Attributed to Factor
Labor Quality		
Hours Worked (efficiency-adjusted)		
Denison (1979)	1948-73/1973-76	10
Denison (1982)	1948-73/1973-81	6
Age-Sex Composition		
Denison (1979)	1948-73/1973-76	3
Denison (1982)	1948-73/1973-81	1
Education		
Denison (1979)	1948-73/1973-76	-12
Denison (1982)	1948-73/1973-81	-3
Research and Development		
Denison (1979)	1948-72/1972-76	3
Griliches	1965-73/1973-77	10
Kendrick	1948-66/1973-78	13
Nadiri (whole economy)	1948-74/1974-78	17
Nadiri (private economy)	1948-74/1974-78	37
Output Composition (resource allocation)		
Denison (1979)	1948-73/1973-76	13
Kutcher, Mark, and Norsworthy	1947-66/1966-73	23
Norsworthy, Harper, and Kunze	1948-65/1965-73 1965-73/1973-78	- 24
Thurow	1948-65/1965-72	-
	1965-72/1972-77	45-50
Wolff	1947-67/1967-76	48
Nordhaus	1948-65/1965-71	77
Denison (1982)	1948-73/1973-81	12

a. Percentage contribution based on Denison's estimate of a 2.97 percentage point decline in overall productivity growth.

Energy. Energy price shocks may have accounted for something like 3 percent to 20 percent of the slowdown, according to estimates cited in Table III-1. These figures perhaps greatly understate the spectrum of opinion on this issue. Some analysts note, for instance, that the productivity slowdown was practically worldwide, and that the timing of the slowdown seemed to coincide with the energy price shock of 1973-1974. Some econometrically derived estimates suggested that much if not all of the slowdown could be attributed to the energy price shock. 18/ Other analysts, such as Denison, argue that energy accounted for a relatively small share of businesses' overall costs, which implied a relatively minor impact on productivity. In general, much of the debate over energy's role centered on the extent to which the oil price shock caused capital to become obsolete. 19/ Conclusive evidence is unavailable on this issue.

Labor Quality. Denison's work cited in the table showed that changes in labor quality had little net effect on productivity because negative factors such as age-sex composition were offset by positive factors such as education. To some extent, this conclusion about age-sex composition depends on the particular dating of the "slowdown." Norsworthy, Harper, and Kunze, for instance, concluded that changes in labor-force composition accounted for something like 15 percent of the slowdown in the private nonfarm business sector in 1965-1973 compared with the earlier postwar period. 20/ In any case, a shift in age-sex composition was a rather significant negative factor in productivity growth throughout much of the postwar period. But because this shift occurred at a fairly steady pace over such a long period, it did not account for much of the productivity slowdown in the 1970s.

A more controversial issue is the role of education and training. The labor force has certainly acquired more years of schooling during the postwar period. But some analysts suggest that the quality of schooling may have deteriorated, or that more years of schooling did not make workers more productive. For instance, average test scores on standardized college

18. See, for instance, John Tatom, "The Productivity Problem," Federal Reserve Bank of St. Louis, *Review* (September 1979), pp. 3-16.

19. See, for example, Martin N. Baily, "Productivity and the Services of Capital and Labor," *Brookings Papers on Economic Activity*, vol. 1 (1981), pp. 1-50.

20. J.R. Norsworthy, M. J. Harper, and K. Kunze, "The Slowdown in Productivity Growth: Analysis of Some Contributing Factors," *Brookings Papers on Economic Activity*, vol. 2 (1979), p. 416.

entrance exams tended to decline from about the mid-1960s to the late 1970s, and some analysts believe that the decline resulted from a deterioration in educational quality. 21/ Others suggest that some workers received more education than they could use productively, in part because young people continue in school for reasons other than to increase their earnings and productivity. 22/

Research and Development. The estimates in Table III-1 suggest that a slowdown in R&D investment had effects on productivity ranging from negligible (Denison) to nearly 40 percent (Nadiri, for the private economy). The primary reason for the large differences may be that measuring the contribution of R&D is so difficult. One issue is whether researchers should attempt to measure it directly (as Kendrick tries to do), or treat it as a statistical residual (as Denison does under the rubric of "contribution to knowledge").

Another issue is the effects on private productivity of government R&D, particularly defense-related R&D. The question is important to the debate on productivity because much of the R&D slowdown in the 1970s was in the category of government-sponsored, particularly defense-related, R&D. Defense R&D probably contributes less, dollar for dollar, to productivity than private, nondefense R&D.

The Composition of Output. The estimates in Table III-1 also attest to large differences in how researchers assess the role of shifts in the composition of output. Most analysts would agree that the movement of workers out of agriculture contributed to growth in productivity, and that as the movement tapered off it contributed to the slowdown in productivity growth. (In the early postwar period, the average level of productivity in farming was comparatively low, although the rate of growth in productivity was comparatively high.) There is disagreement about other sectors, particularly the service-producing sector. While growth in productivity appears to have been slower in the service-producing sector than in the goods-producing sector, and while employment has grown much more rapidly in services than in the goods sector, services have increased their share of output by much less

21. For a recent analysis of educational achievement, see Congressional Budget Office, *Trends in Educational Achievement* (April 1986).

22. See Richard Freeman, "Overinvestment in College Training?" *Journal of Human Resources*, vol. X, no. 3 (Summer 1975), pp. 287-311. Not all researchers agree. See Russell W. Rumberger, "The Economic Decline of College Graduates: Fact or Fallacy?" *Journal of Human Resources*, vol. XV, no. 1 (Winter 1980), pp. 99-112.

than the shift in employment shares. 23/ Also, while growth in productivity may have been slower for services than for goods-producing industries, the difference in average productivity levels has not been great. In sum, the range of opinion as to the relative importance of shifts in the composition of output remains broad. The estimates in the table find such shifts accounting for from 12 percent to 50 percent of the slowdown. 24/

The Outlook for Productivity

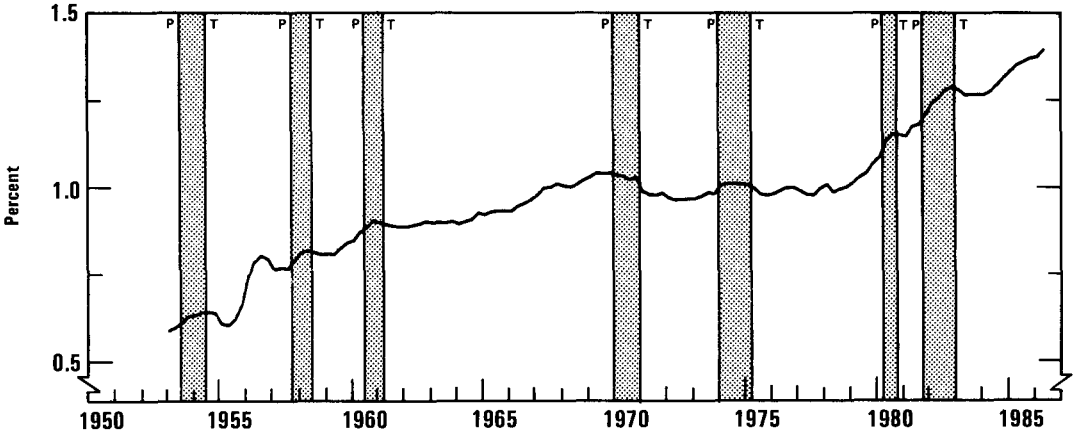
Many of the factors that are believed to have contributed to the slowdown in productivity have reversed in recent years, or at least moderated. The baby boom generation of 15 years ago is now swelling the ranks of the more experienced workers, and the number of teenagers has been falling. Correspondingly, the labor force is growing less rapidly, which should help to push up the capital/labor ratio. Government regulations have in some respects been eased, and at any rate are not being introduced as fast as in the earlier period. Industrial R&D as a percent of GNP has surged to new highs (see Figure III-7). Oil prices began plunging late in 1985. (In the short run, however, any sharp change in energy prices, whether an increase or a decrease, can be detrimental to productivity.) Labor and management have put more emphasis on increasing productivity. The Tax Reform Act of 1986 has reduced marginal tax rates on individuals, which should encourage work, and done much to equalize taxes on different kinds of business capital, which should contribute to greater efficiency for any given size of the capital stock. (On the other hand, the new law has raised taxes on the income from capital, which tends to discourage investment.) These new conditions have caused some analysts to expect a major rebound in the performance of productivity. 25/ Actual productivity performance, however, suggests little

23. Service-producing industries accounted for approximately 50 percent of gross business domestic product in 1950, and 60 percent in 1985. If the weights had remained at the 1950 level, the overall level of productivity would have been only about 1.2 percent higher in 1985.

24. For a more detailed discussion of the issues concerning the role of different factors in the productivity slowdown, see Congressional Budget Office, *The Productivity Problem: Alternatives for Action*(January 1981); and more recently, Martin N. Baily, "What Has Happened to Productivity Growth?" *Science*, vol. 234 (October 24, 1986), pp. 443-451.

25. See John W. Kendrick, "Productivity: The Key to Future Prosperity," in *A Symposium on the 40th Anniversary of the Joint Economic Committee*, Hearings before the Joint Economic Committee, 99:1 (January 16 and 17, 1986).

Figure III-7.
Real Expenditures of Industry on Research and Development as a Percent of Real Gross National Product



SOURCES: Congressional Budget Office; National Science Foundation.

cause for optimism, particularly in the services sector. The lack of much improvement so far may reflect the relatively long lags between the performance of productivity and its determinants.

Not all factors favor more rapid growth in productivity. Business fixed investment grew very rapidly in the first two years of the current expansion but has not grown rapidly in the last two years. The near-term outlook is not very positive either. Among the reasons are low use of capacity, less favorable tax treatment for new investments under the Tax Reform Act, high vacancy rates for office buildings, and problems in the energy sector.

Measurement Issues

To some extent, the slowdown in productivity growth may be more apparent than real. Growth in productivity is very hard to measure accurately; most analysts believe that it is underestimated. More controversial is the view that a significant part of the slowdown in productivity is illusory because of measurement problems.

Productivity is generally not measured directly; instead, information on the market value of output is combined with an estimate of price change

to derive an estimate of output in constant dollars. The estimate of price change is complicated by the need to adjust for quality changes in some products and for the introduction of new products or services. The methods used for making such adjustments are often not very satisfactory, and they are frequently controversial. The problem of measuring output involves difficult conceptual issues. For instance, experts differ widely concerning what kinds of quality adjustments are feasible to make and how they should be made. 26/

The difficulties are greater for services, where output and input are hard to separate. This is the principal reason that the Bureau of Labor Statistics omits the government and private nonprofit sectors from its official measures of productivity. Doing so avoids many difficult measurement problems, such as trying to measure quality change for nonprofit hospital services where technological change has been very rapid, or attempting to measure quality changes in education.

The Department of Commerce, according to a recent study, uses input prices--for example, wage rates--to deflate output measures for more than 20 percent of the service sector. Where this is done, "real" output and "real" input measures move together, and by assumption there is no growth in productivity. The author of the study believes this may be one reason why available measures show essentially no improvement in the nonfarm, nonmanufacturing sector since the early 1970s. He points out that the more detailed industry productivity series maintained by the Bureau of Labor Statistics shows modest, but still significant, productivity gains in the bulk of service industries, including banking, gasoline service stations, and railroad transportation. 27/

An additional problem in measuring output for individual sectors is that it is necessary to measure accurately the inputs from other sectors.

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26. See National Research Council, *Measurement and Interpretation of Productivity*, National Academy of Sciences (1979), pp. 88-121, and, more recently, Jerome Mark, "Measuring Single-factor and Multifactor Productivity," *Monthly Labor Review*, vol. 109, no. 12 (December 1986), pp. 3-11. In addition, the difficulties inherent in measuring aggregate production are very broad. The discussion here is limited to the concepts of the current national income accounts. For instance, no account is taken of the quality of the environment in current measures of GNP. The value of home services is also not included. Neither is the underground economy.

27. John W. Kendrick, "The U.S. Business Economy: Productivity Trends and Prospects," *AEI Economist* (Washington, D.C.: American Enterprise Institute, August 1986).